CLAIMS

What is claimed is:

1. A method for reducing data in the form of successive groups of N values, the method comprising:

A. finding the largest X values of the N values of each group;

B. setting all but the largest X values of each group equal to zero;

C. averaging W respective ones of the N values produced in A. and B. to produce N average values;

D. finding the largest Y of the N average values, where Y is less than X; and

E. setting the largest Y of the N average values equal to a first binary value, and a remainder of the N average values equal to a second binary value.

2. The method of claim 1, wherein the first binary value is one and the second binary value is zero.

3. The method of claim 1, wherein in the averaging in C., the values not set equal to zero in B. remain unchanged.

4. The method of claim 1, wherein in the averaging in C., the values not set equal to zero in B. remain representative of initial actual values.

5. The method of claim 1, wherein N=48, W=5, X=12, and Y=8.

6. A method for providing a digital representation of a signal, comprising:

dividing the signal into a series of frames;

for each frame, dividing a spectrum of the signal into a series of frequency segments;

determining which of a number of frequency segments of said series of frequency segments have largest amplitudes in said spectrum of said frame;

setting a value of zero for all of said frequency segments other than the number having the largest amplitudes;

using a representative value for said frequency segments having the largest amplitudes, wherein each said representative value is representative of amplitude associated with the respective frequency segment,

averaging respective values, for a series of frames, to produce a series of average values;

selecting a number of the average values which are largest average values; and

producing said digital representation by setting bits to a first binary value for said selected number of the average values, and setting bits set to a second binary value for all other average values.

7. The method of claim 6, wherein the number of frequency segments of said series of frequency segments

having largest amplitudes in said spectrum of said frame is predetermined.

8. The method of claim 6, wherein the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is a predetermined fixed number.

9. The method of claim 6, wherein the number of the average values having largest average values that are selected is a predetermined number.

10. The method of claim 6, wherein the number of the average values having largest average values that are selected is a predetermined fixed number.

11. The method of claim 6, wherein:

the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is predetermined; and

the number of the average values having largest average values that are selected is a predetermined number.

12. The method of claim 6, wherein:

averaging is performed on data from five frames;

the spectrum is divided into forty eight frequency segments;

a value representative of amplitude is used for twelve of the frequency segments having the largest amplitudes; and

the number of average values selected is eight.

13. The method of claim 6, wherein said first binary value is one and said second binary value is zero.

14. The method of claim 6, wherein determining which of a number of frequency segments of said series of frequency segments have largest amplitudes in said spectrum of said frame comprises performing a Fourier transform on the signal.

15. The method of claim 14, wherein said transform is a Discrete Fourier Transform.

16. The method of claim 6, wherein averaging respective values, for a series of frames, to produce a series of average values includes averaging the values of zero.

17. The method of claim 6, further comprising:

comparing said digital representation to a set of predefined digital representations corresponding to known content; and

using results of said comparison to determine whether the signal contains said known content.

18. The method of claim 17, wherein said signal is a broadcast signal, and said content comprises a series of broadcast items.

19. The method of claim 17, wherein said signal is an audio signal.

20. The method of claim 17, wherein said signal is representative of music.

21. The method of claim 17, wherein said signal is representative of a song.

22. The method of claim 6, wherein said signal is an audio signal.

23. The method of claim 6, further comprising:

providing a reference library of digital reference representations;

comparing the digital representation of said signal to said reference representations in said library; and

determining whether said representation of said signal matches one of said digital representations in said reference library.

24. An apparatus for reducing data in the form of successive groups of N values, the apparatus comprising:

A. means for finding the largest X values of the N values of each group;

B. means for setting all but the largest X values of each group equal to zero;

C. means for averaging W respective ones of the N values produced in A. and B. to produce N average values;

D. means for finding the largest Y of the N average values, where Y is less than X; and

E. means for setting the largest Y of the N average values equal to a first binary value, and a remainder of the N average values equal to a second binary value.

25. The apparatus of claim 24, comprising means for setting the first binary value to one and the second binary value to zero.

26. The apparatus of claim 24, wherein in the averaging in C., the values not set equal to zero in B. remain unchanged.

27. The apparatus of claim 24, wherein in the averaging in C., the values not set equal to zero in B. remain representative of initial actual values.

28. The apparatus of claim 24, wherein N=48, W=5, X=12, and Y=8.

29. The apparatus of claim 24, comprising a programmed digital computer.

30. An apparatus for processing a signal, comprising:

a divider which divides the signal into a series of frames;

an arrangement for dividing the spectrum of the signal into a series of frequency segments;

a processor for determining which of a number of frequency segments of said series of frequency segments have largest amplitudes in said spectrum of said frame;

a first value setter for setting a value of zero for all of said frequency segments other than the number having the largest amplitudes;

a second value setter for setting a representative value for said frequency segments having the largest amplitudes, wherein each said representative value is representative of amplitude associated with the respective frequency,

an averaging arrangement for averaging respective values, for a series of frames, to produce a series of average values;

a selector for selecting a number of the average values which are largest average values; and

a binary value generator for producing a digital representation by setting bits to a first binary value for said selected number of the average values, and for setting bits to a second binary value for all other average values.

31. The apparatus of claim 30, wherein the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is a predetermined number.

32. The apparatus of claim 30, wherein the number of frequency segments of said series of frequency segments

having largest amplitudes in said spectrum of said frame is a predetermined fixed number.

33. The apparatus of claim 30, wherein the number of the average values having largest average values that are selected is a predetermined number.

34. The apparatus of claim 30, wherein the number of the average values having largest average values that are selected is a predetermined fixed number.

35. The apparatus of claim 30, wherein:

the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is a predetermined number; and

the number of the average values having largest average values that are selected is a predetermined number.

36. The apparatus of claim 30, wherein:

the averaging is performed on data from five frames;

the spectrum is divided into forty eight frequency segments;

a value representative of amplitude is set for twelve of the frequency segments having the largest amplitudes; and

the number of average values selected is eight.

37. The apparatus of claim 30, wherein said first binary value is one and said second binary value is zero.

38. The apparatus of claim 30, further comprising:

apparatus for performing a Fourier transform on the signal to determine which of a number of frequency segments of said series of frequency segments have largest amplitudes.

39. The apparatus of claim 38, wherein said Fourier transform is a Discrete Fourier Transform.

40. The apparatus of claim 30, wherein said averaging arrangement averages the values of zero when producing a series of average values.

41. The apparatus of claim 30, further comprising:

a comparator for comparing said digital representation to a set of predefined digital representations corresponding to known content, to determine whether the signal includes said known content.

42. The apparatus of claim 41, configured to process a broadcast signal, and wherein said content comprises a series of broadcast items.

43. The apparatus of claim 41, configured to process an audio signal.

44. The apparatus of claim 43, configured to process a signal representative of music.

45. The apparatus of claim 41, configured to process a signal representative of a song.

46. The apparatus of claim 30, wherein said signal is an audio signal.

47. The apparatus of claim 30, further comprising:

a reference library of reference digital representations; and

a comparator for comparing the digital representation of said signal to said representations in said library to determine whether said digital representation of said signal matches one of said reference digital representations in said reference library.

48. An article of manufacture comprising a computer usable medium having computer readable program code embodied therein for causing a computer to reduce data in the form of successive groups of N values, by a method comprising:

A. finding the largest X values of the N values of each group;

B. setting all but the largest X values of each group equal to zero;

C. averaging W respective ones of the N values produced in A. and B. to produce N average values;

D. finding the largest Y of the N average values, where Y is less than X; and

E. setting the largest Y of the N average values equal to a first binary value, and a remainder of the N average values equal to a second binary value.

49. The article of manufactur of claim 48, having computer readable code for causing the first binary value to be one and the second binary value to be zero.

50. The article of manufacture of claim 48, having computer readable code for executing the method so that in the averaging in C., the values not set equal to zero in B. remain unchanged.

51. The article of manufacture of claim 48, having computer readable code for executing the method so that in the averaging in C., the values not set equal to zero in B. remain representative of initial actual values.

52. The article of manufacture of claim 48, having computer readable code for executing the method so that N=48, W=5, X=12, and Y=8.

53. An article of manufacture comprising a computer usable medium having computer readable program code embodied therein for causing a computer to provide a digital representation of a signal, by a method comprising:

dividing the signal into a series of frames;

for each frame, dividing a spectrum of the signal into a series of frequency segments;

determining which of a number of frequency segments of said series of frequency segments have largest amplitudes in said spectrum of said frame;

setting a value of zero for all of said frequency segments other than the number having the largest amplitudes;

using a representative value for said frequency segments having the largest amplitudes, wherein each said representative value is representative of amplitude associated with the respective frequency segment,

averaging respective values, for a series of frames, to produce a series of average values;

selecting a number of the average values which are largest average values; and

producing said digital representation by setting bits to a first binary value for said selected number of the average values, and setting bits to a second binary value for all other average values.

54. The article of manufacture of claim 53, wherein, in the method, the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is predetermined.

55. The article of manufacture of claim 53, wherein, in the method, the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is a predetermined fixed number.

56. The article of manufacture of claim 53, wherein, in the method, the number of the average values having largest average values that are selected is a predetermined number.

57. The article of manufacture of claim 53, wherein, in the method, the number of the average values having largest average values that are selected is a predetermined fixed number.

58. The article of manufacture of claim 53, wherein, in the method:

the number of frequency segments of said series of frequency segments having largest amplitudes in said spectrum of said frame is predetermined; and

the number of the average values having largest average values that are selected is a predetermined number.

59. The article of manufacture of claim 53, wherein, in the method:

averaging is performed on data from five frames;

the spectrum is divided into forty eight frequency segments;

a value representative of amplitude is set for twelve of the frequency segments having the largest amplitudes; and

the number of average values selected is eight.

60. The article of manufacture of claim 53, wherein, in the method, said first binary value is one and said second binary value is zero.

61. The article of manufacture of claim 53, wherein, in the method, determining which of a number of frequency segments of said series of frequency segments have largest amplitudes in said spectrum of said frame comprises performing a Fourier transform on the signal.

62. The article of manufacture of claim 61, wherein, in the method, said transform is a Discrete Fourier Transform.

63. The article of manufacture of claim 53, wherein, in the method, averaging respective values, for a series of frames, to produce a series of average values includes averaging the values of zero.

64. The article of manufacture of claim 53, wherein the method further comprises:

comparing said digital representation to a set of predefined digital representations corresponding to known content; and

using results of said comparison to determine whether the signal contains said known content.

65. The article of manufacture of claim 64, wherein, in the method, said signal is a broadcast signal, and said content comprises a series of broadcast items.

66. The article of manufacture of claim 64, wherein, in the method, said signal is an audio signal.

67. The article of manufacture of claim 66, wherein, in the method, said signal is representative of music.

68. The article of manufacture of claim 66, wherein, in the method, said signal is representative of a song.

69. The article of manufacture of claim 53, wherein, in the method, said signal is an audio signal.

70. A method for determining likelihood of a match between a first set of data having Y of N bits set equal to a first binary value and a remainder of the bits set equal to a second binary value, and a second set of data also having Y of N bits set equal to a first binary value and a remainder of the bits set equal to a second binary value, the method comprising:

determining the general probabilities of Y of N bits in said first set of data and in said second set of data being the same; and

heuristically processing the probabilities to produce a series of match values based on the number of respective bits in the first set of data and in the second set of data that are identical.

71. The method of claim 70, wherein said heuristically processing comprises:

assigning a match of n out of Y values a value of 1;

normalizing remaining values to the value of 1 to produce resulting numbers;

multiplying the resulting numbers by a constant to produce multiplied numbers; and

subtracting the multiplied numbers from 1 to produce the match values.

72. The method of claim 71, further comprising setting match values greater than a predetermined value to values substantially equal to 1.